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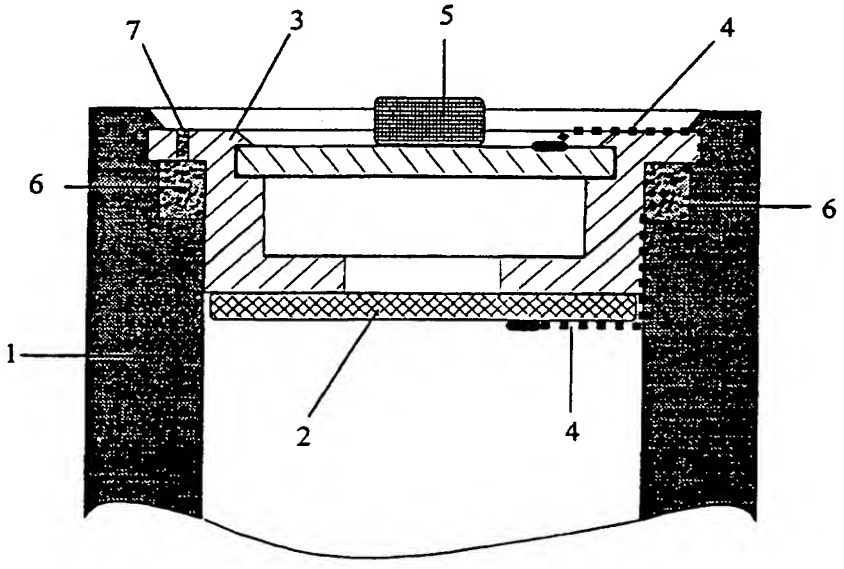
(54) Electrochemical measuring sensor

(57) An electrochemical sensor for detecting gases in a fluid medium of the type having a housing 1 containing two electrodes and electrolyte which are separated from gas to be measured by a gas permeable, liquid impermeable membrane (not shown). To seal in a hermetic manner the contact wires 4 which lead out of the measuring cell from one of the electrodes 2, an annular chamber 6, which extends in parallel with the circumferential direction of the housing 1, is provided between the measuring-cell cover 3 and housing 1. The chamber 6 is filled with a sealing material which is resistant to the electrolyte and to temperature and the contact wires 4 pass through this chamber 6, preferably so that they slope from the inside to the outside. The sealing material may be an unhardened epoxy resin, a silicone-based or polytetrafluoroethylene-based high-vacuum grease or a silicone adhesive.



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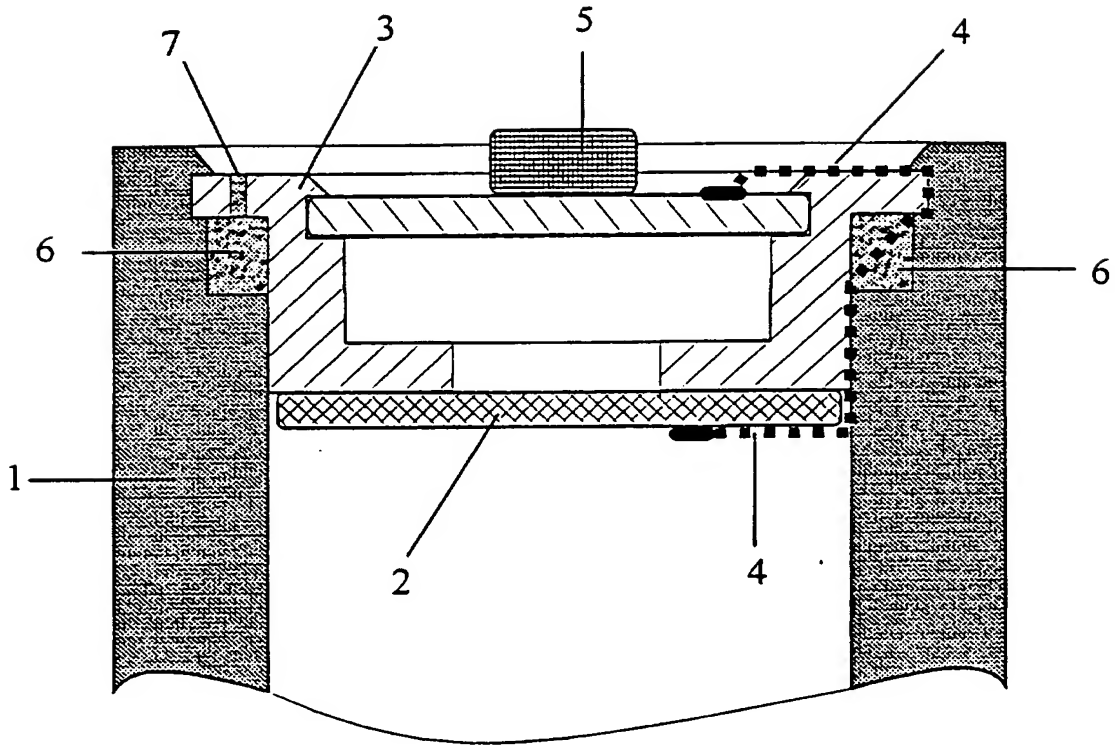

ELECTROCHEMICAL MEASURING CELL

This invention relates to an electrochemical measuring cell for detecting a component in a fluid medium.

An electrochemical measuring cell of this type is described in DE-A-4335409. In this known measuring cell, one measuring electrode and one counter electrode are located in a housing. Arranged in the end of the housing, i.e. in the end in which is located the counter electrode, are the contact wires of the measuring cell, which usually pass between the housing wall and the measuring-cell cover to the exterior of the measuring cell, where they are connected to a printed circuit board having a pre-amplifier, a signal-processing device and further electronic components, and are also connected on the output side to a connector for transmitting and evaluating the measurement signals.

The counter electrode and the measuring electrode are in liquid connection with an electrolyte (i.e. an electrolyte solution) which is suited to each type of measuring cell, and to the intended use thereof, and which is located in the electrolyte chamber. These electrolytes, e.g. phosphoric or sulphuric acid, have properties which are caustic and corrosive to a lesser or greater extent. It is therefore important to seal the electrolyte chamber hermetically, because otherwise, when handling the measuring cell, injuries can occur and measuring or evaluating apparatus can be damaged. According to the prior art, the electrolyte chamber is sealed by O-rings, by bonding and/or by heat-sealing.

It has, however, now been established that these measures are not sufficient, because the electrolyte can reach the exterior at the junction between housing wall and measuring-cell cover or even in the vicinity

of the contact wires, which are usually made of platinum. These leakages occur particularly in the event of large temperature fluctuations, because the materials (i.e. precious metals and plastics) which are in contact have very different heat expansion coefficients.

The object of the present invention is to improve an electrochemical measuring cell such that, given a slightly modified housing structure, a hermetic seal is possible, in order to prevent the electrolyte from exiting.

According to the present invention, there is provided an electrochemical measuring cell for detecting a component in a fluid medium, which cell comprises, within a housing, a measuring electrode and a counter electrode which are in liquid communication with an electrolyte, wherein a part of the housing is closed by a gas-permeable and electrolyte-impermeable membrane via which the component to be detected is brought into diffusion contact with the measuring electrode, wherein another part of the housing is closed by a cover, and wherein a recess is provided between the cover and the housing and is filled with a sealing material which is resistant to the electrolyte and to temperature.

Thus, according to the invention, a recess, which can extend in parallel with the circumferential direction of the housing wall, is provided between the measuring-cell cover and the housing wall and is filled with a sealing material which is resistant to the electrolyte and to temperature.

Preferably, one or more contact wires pass through the recess filled with the sealing material.

Preferably, the contact wire or wires extend through the recess in a manner such that they slope from the inside towards the outside and are embedded in

the sealing material.

Preferably, the sealing material is one or more of an unhardened epoxy resin, a silicone-based high-vacuum grease, a polytetrafluoroethylene-based high-vacuum grease, and a silicone adhesive.

Preferably, at least one opening leads through the cover and/or the housing into the recess, in order for the recess to be filled with the sealing material.

The advantage of the invention lies in the fact that known substances can be used as a sealing material and that only simple structural changes are required. A chemical-resistant resin, a grease or a silicon adhesive can be used as the sealing material. Suitable substances are, for example, epoxy resin without hardener, silicone-based high-vacuum grease or polytetrafluoroethylene-based high-vacuum grease.

It has proved to be particularly advantageous for the sealing material to be injected through a small opening into the recess and to thus fill the recess. It is further advantageous for the contact wires to pass through the recess and to be embedded in the sealing material.

An exemplary embodiment of the invention is explained in greater detail in the following with the aid of the single Figure.

The single Figure shows in section one end of an electrochemical measuring cell in longitudinal section, the cell having a housing 1, which is cylindrical in this particular case, and which, while being gas-permeable in this particular case, is in every case is impermeable to the electrolyte. A suitable material is, for example, polytetrafluoroethylene (PTFE). The Figure shows a counter electrode 2, the underside of which is connected to a contact wire 4. Beneath the counter electrode 2 are an electrolyte chamber and also other components of the cell, which components are not

represented.

These other components of the cell include a gas-permeable and electrolyte-impermeable membrane, which closes the cell and is normally located at the other end of the cell. This membrane allows the component to be detected to enter the cell. The housing 1, being gas-permeable, allows gas produced by electrolytic processes within the cell to escape outwards, thereby preventing too high a gas concentration within the cell. However, the escape of electrolyte from the cell must of course be impeded.

For both the membrane and housing, PTFE is a preferred material, but with different properties, i.e. for the housing the PTFE must be thicker and stable (rigid) whereas for the membrane the PTFE must be thinner and flexible, with a high diffusion rate in respect of the component to be detected.

According to the invention, the cell has a recess which is in the form of a groove-like annular chamber 6 and which in the simplest case is formed as a result of the fact that the inside wall of the housing 1 is shortened by the amount of the height of the annular chamber 6 while the dimensions of the remaining components of the measuring cell are otherwise the same.

In the Figure, on the right-hand side, the contact wires 4 of the measuring cell pass diagonally through the annular chamber 6 and then pass between the external wall of the housing 1 and a cover 3 for the cell, towards the outside and to a printed circuit board having electronic signal-amplifying components and, if appropriate, further suitable signal-processing components, and also ultimately to a connector 5 for transmitting the signals for further evaluation or display.

In the simplest case, the annular chamber 6 is

filled with a suitable sealing material through at least one opening 7 after the measuring cell has been assembled. The opening 7 can be in the form of a bore in the cover 3. The purpose of the sealing material is to prevent the leakage of the electrolyte, even in the event of strong temperature fluctuations and pressure surges, and to embed the contact wires 4 hermetically. Chemical-resistant resins, greases or adhesives have proved to be suitable materials. Preferably, epoxy resins without hardeners are used. Silicone-based high-vacuum greases and polytetrafluoroethylene-based high-vacuum greases are likewise suitable sealing materials, as are silicone adhesives.

Claims

1. An electrochemical measuring cell for detecting a component in a fluid medium, which cell comprises, within a housing, a measuring electrode and a counter electrode which are in liquid communication with an electrolyte, wherein a part of the housing is closed by a gas-permeable and electrolyte-impermeable membrane via which the component to be detected is brought into diffusion contact with the measuring electrode, wherein another part of the housing is closed by a cover, and wherein a recess is provided between the cover and the housing and is filled with a sealing material which is resistant to the electrolyte and to temperature.

2. A cell according to claim 1, wherein one or more contact wires pass through the recess filled with the sealing material.

3. A cell according to claim 2, wherein the contact wire or wires extend through the recess in a manner such that they slope from the inside towards the outside and are embedded in the sealing material.

4. A cell according to any of claims 1 to 3, wherein the sealing material is one or more of an unhardened epoxy resin, a silicone-based high-vacuum grease, a polytetrafluoroethylene-based high-vacuum grease, and a silicone adhesive.

5. A cell according to any of claims 1 to 4, wherein at least one opening leads through the cover and/or the housing into the recess, in order for the recess to be filled with the sealing material.

6. A cell according to claim 1, substantially as hereinbefore described with reference to, and as shown in, the drawing.

7. Electrochemical measuring cell for detecting components in fluid media, which measuring cell contains within a housing one measuring electrode and

one counter electrode, which are in liquid connection with an electrolyte, and with one side of the housing having a membrane, which is gas-permeable and impermeable to the electrolyte and by way of which the components to be detected are brought into diffusion contact with the measuring electrode, and the other side of the housing being closed with a measuring-cell cover, characterised in that a recess which extends in parallel with the circumferential direction of the housing is provided between measuring-cell cover and housing and is filled with a sealing material which is resistant to the electrolyte and to temperature.

The Patent Office

Application No: GB 9607042.0
Claims searched: 1-7

Examiner: David Mobbs
Date of search: 26 June 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): G1N NBPME, NBPMX.

Int Cl (Ed.6): G01N 27/403, 27/49.

Other: NONE.

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2,021,773 A	(RADIOMETER A/S) - see particularly lid 12 and epoxy resin filling 13 on page 4 lines 6-7.	1-3, 5.
X	EP 0,298,570 A2	(BACHARACH INC) - see particularly septums 86, 87, column 9 lines 9-19 and column 10 lines 31-35.	1, 2, 5.

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.